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BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte YONG-TAE KIM,
SU-SUK CHOI, YUN-SUK CHOI,
and KYOUNG-HEE LEE

Appeal 2009-014468
Application 10/664,157
Technology Center 1700

Before BRADLEY R, GARRIS, CHARLES F. WARREN, and JEFFREY T. SMITH, *Administrative Patent Judges*.

WARREN, *Administrative Patent Judge*.

DECISION ON APPEAL

Applicants appeal to the Board from the decision of the Primary Examiner finally rejecting claims 1-25 in the Office Action mailed March 16, 2007. The Examiner subsequently refused to allow claim 1-19 and 21-23 as amended in the Amendment filed May 25, 2007, as entered in the Office Action mailed June 12, 2007, the Amendment further cancelling claim 20. Claims 1-19 and 21-25 remain for consideration on appeal. 35 U.S.C. §§ 6 and 134(a) (2002); 37 C.F.R. § 41.31(a) (2007).

We reverse the decision of the Primary Examiner.

Claim 1 illustrates Appellants' invention of a negative electrode for a lithium battery, and is representative of the claims on appeal:

1. A negative electrode for a lithium battery, comprising:

a lithium metal layer; and

a protective layer on the lithium metal layer, wherein the protective layer includes an organosulfur compound and an ionic conductive polymer to help facilitate transfer of lithium ions.

Appellants request review of the grounds of rejection under 35 U.S.C. § 103(a) advanced on appeal by the Examiner: claims 1-7, 9-17, 19, and 21-24 over Skotheim (US 5,961,672) in view of Sotomura (US 6,245,458 B1); claims 8 and 18 over Skotheim in view of Sotomura, further in view of Zuiho (JP 10-101793 A);[1] claims 24 and 25 over Skotheim in view of Sotomura, further in view of Chu (US 5,523,179) and Fauteux (US 6,030,719). Br. 3; Ans. 4, 5, and 6.[2]

Opinion

Appellants principally submit that the Examiner erred in concluding that one of ordinary skill in the art would have combined Skotheim and Sotomura leading to coating Sotomura's organosulfur protective layer on Skotheim's lithium anode, which is coated with a film of lithium ion-conductive polymer that stabilizes the lithium anode against dendrite formation, to obtain a secondary battery with high energy density and current output as claimed in claim 1. Br. 5-7; Ans. 4. According to

[1] We considered the Abstract of Zuiho prepared by the Japan Patent Office relied on by the Examiner. Ans. 6.

[2] We considered the Supplemental Examiner's Answer mailed July 14, 2009,

Appellants, Skotheim's lithium anode has "a thin film of lithium ion-conductive polymer" and does not have "a protective layer including an organosulfur compound and an ionic conductive polymer." App. Br. 6. Appellants contend that Sotomura's composite electrode, including an organosulfur compound and a polymer electrolyte, does not include a lithium metal layer and is used as a cathode electrode, not an anode electrode. Br. 6, citing Sotomura col. 1, ll. 10-11, col. 4, l. 15, col. 5, ll. 43-58, and col. 5, l. 66 to col. 6, l. 2. Thus, Appellants argue that it is clear from Sotomura that the organosulfur protective layer is not a part of a metallic lithium anode, pointing out that "lithium ions do not constitute a lithium metal layer." Br. 7. Appellants further contend that in both Skotheim and Sotomura, the anode includes a lithium metal layer and the cathode does not, and "[n]either reference discloses the inclusion of an organosulfur and an ionic conductive polymer in an electrode comprising a lithium metal layer" as claimed. Br. 7.

The Examiner finds that Skotheim "discloses a secondary battery with a composite lithium anode that stabilizes against dendrite formation with a thin film of lithium ion-conductive polymer interposed between the lithium metal and the electrolyte," and "the electroconductive polymer film may be any conjugated structure, which is capable of being doped electrically conductive by lithium ions." Ans. 4, citing Skotheim col. 2, ll. 41-45, and col. 6, ll. 55-58. The Examiner finds that Sotomura "discloses an electrode composite that can be used in a metallic lithium anode" which provides a secondary battery that exhibits high energy density and good cycle life. Ans. 4, citing col. 2, ll. 1-4 and 39-44, col. 4, ll. 15 and 56-60, and col. 5,

ll. 43-58. The Examiner contends that "[w]hile [Sotomura] uses the electrode composite in the cathode for some examples, [Sotomura] maintained an extensive teaching of the composite electrode used broadly." Ans. 9, citing Sotomura col. 1, l. 65 to col. 2, l. 4, col. 2, ll. 10-14, and col. 12, ll. 44-59. The Examiner contends that Sotomura "discloses an organic disulfur compound having a thiol or thiolate group (as an example) combined with a metallic lithium anode . . . as the electrode composite." Ans. 11 (emphasis in original), citing Sotomura col. 1, l. 65 to col. 2, l. 4. The Examiner argues that Sotomura's disclosure of an "organo-sulfur containing composite electrode . . . [that] is doped with lithium ions is evidence that this organo-sulfur containing composite electrode can be used in [Skotheim] as the ionic conductive layer because [Skotheim] requires that the polymer used can [sic] any polymer that is capable of being doped with lithium ions." Ans. 11, citing Sotomura col. 1, l. 65 to col. 2, l. 4.

The Examiner further contends that in a rechargeable or secondary battery, the electrodes reverse depending on whether the battery is charging or discharging such that the discharging anode becomes the charging cathode. Ans. 8 and 12. Thus, the Examiner argues that the preambular term "anode is not given patentable weight" since the claims encompass compositions which can be a cathode. Ans. 8. The Examiner further argues that Skotheim "discloses an anode with a lithium layer, electrolyte, and any ionic conductive protective layer that is capable of doping lithium ions," and Sotomura "discloses a composite electrode comprising an organosulfur layer that is capable of doping lithium ions and provides motivation." Ans. 12.

We initially determine that contrary to the Examiner's position, the preambular term "anode" would be considered by one of ordinary skill in the

art, in light of the Specification, to be the electrode customarily considered the "anode" electrode of a lithium secondary battery. *See generally* Spec., Skotheim, and Sotomura. The plain language of claim 1 specifies that the anode comprises at least, among other things, a lithium metal layer, and a protective layer that includes at least, among other things, any organosulfur compound and an ionic conductive polymer that facilities transfer of lithium ions.

We find Skotheim would have disclosed to one of ordinary skill in the art a lithium anode for a lithium battery, wherein the lithium anode is coated with a vacuum evaporated thin film of a lithium-ion conducting polymer between the lithium metal and the electrolyte. Skotheim, e.g., col. 2, ll. 45; *see also* col. 5, l. 30 to col. 6, l. 54. "Useful starting polymers, for the formation of the electroconductive polymer film may be any conjugated structure which is capable of being doped electrically conductive by lithium ions." Skotheim col. 6, ll. 55-58.

We find Sotomura would have disclosed to one of ordinary skill in the art a composite electrode, useful as a cathode of a lithium secondary battery, that "comprises a composition which contains an organic sulfide compound with at least a thiol or thiolate group in the molecule, polyaniline, and sulfur" on an electrically conductive supporting member, wherein at least the surface of the electrically conductive supporting member can be copper, silver, copper alloy or silver alloy, or is at least a powder of these metals, and the electrically conductive supporting member can be, among other things, "a metallic foil comprising titanium, aluminum, stainless steel or the like" which can be coated by an electrically conductive polymer film. Sotomura col. 2, ll. 47-58, col. 4, ll. 56-62, and col. 12, ll. 44-50; *see also*

col. 3, l. 36 to col. 4, l. 55, and col. 4, l., 63 to col. 5, l. 35. The composite electrode can also contain an electrically conductive agent and an electrolyte containing a cation M^+, and an organic polymer binder. Sotomura col. 5, ll. 35-60. The method for producing the composite electrode comprises the steps of dissolving the organic sulfide compound, into a pyrrolidone compound, adding polyaniline and the sulfur powder to form a slurry, and applying the slurry to an electrically conductive supporting member and heating in vacco or under an inert atmosphere. Sotomura col. 2, l. 59 to col. 3, l. 16. Sotomura describes a secondary battery containing the composite electrode as a cathode and "an anode containing lithium as the active material," such as "metallic lithium, lithium cloy, and a carbon material and a lithium-containing composite oxide." Sotomura col. 5, l. 66 to col. 6, l. 6. Sotomura illustrates exemplary composite electrodes as cathodes in lithium batteries which have a foil of metallic lithium as an anode. Sotomura col. 7, ll. 47-52, Fig. 1, and cols. 6-12.

We find that Sotomura would have acknowledged as "Background" that electrodes comprising conductive polymers are used as cathodes in lithium secondary batteries which have an anode comprising metallic lithium, and that certain known organic disulfide compounds having a thiol or thiolate group in their molecules used in cathodes result in a battery which provides a high voltage of not lower than 3V when combined with a metallic lithium anode. Sotomura col. 1, l. 12 to col. 2, l. 4.

On this record, we agree with Appellants that the Examiner has not established that one of ordinary skill in this art would have been led to the claimed anode for a lithium battery by the combined teachings of Skotheim and Sotomura, as we find that neither reference would have disclosed a

lithium metal electrode that is coated with an organosulfur compound and an ionic conductive polymer as claimed in claim 1 as Appellants point out. Indeed, contrary to the Examiner's position, we fail to find in Sotomura's "Background" a lithium anode that is coated with an organic disulfide compound, and Sotomura's described composite electrode would not have led one of ordinary skill in the art to use lithium metal as part of Sotomura's composite electrode. Thus, the combination of Skotheim and Sotomura would not have suggested to one of ordinary skill in the art to incorporate Sotomura's composition on Skotheim's lithium metal anode to obtain a lithium battery having the properties taught by Sotomura as argued by the Examiner.

Accordingly, the Examiner has not established a case of obviousness based on the combination of Skotheim and Sotomura alone, and for the same reasons, as combined with Zuiho and with Chu and Fauteux. *See* Br. 7-8. Thus, we reverse the grounds of rejection of claims 1-19 and 21-23 under 35 U.S.C. § 103(a)

The Primary Examiner's decision is reversed.

REVERSED

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